

**NOAA COASTAL MAPPING PROGRAM
PROJECT COMPLETION REPORT
PROJECT GA0201**

**HILTON HEAD ISLAND TO WASSAW ISLAND
SAVANNAH RIVER TO CONFLUENCE WITH THE ATLANTIC OCEAN**

**SOUTHERN PORTION OF THE SOUTH CAROLINA SHORELINE AND THE
NORTHERN PORTION OF GEORGIA SHORELINE**

Introduction

Coastal Mapping Program (CMP) Project GA0201 provides a highly accurate database of new digital shoreline data of the southern portion of the South Carolina (SC) shoreline and the northern portion of the Georgia (GA) shoreline. The project area extends from near the center of Hilton Head Island, SC to near the southern end of Wassaw Island, GA. The project area also includes the Savannah River from just North of Port Wentworth, GA, to the river's confluence with the Atlantic Ocean and the other rivers and bays within the project limits.

Completion of this project resulted in controlled aerial photography and Digital Cartographic Feature Files (DCFF) of the coastal zone meeting the requirements of the NOAA CMP.

The project database consists of information measured and extracted from aerial photography and metadata related to photogrammetric compilation. Base mapping was conducted in a digital environment using stereo softcopy, stereo analytical photogrammetry and associated cartographic practices. Project survey data is referenced to North American Datum of 1983 (NAD 83).

Project Design

The design of project GA0201 was based on a comparison of image analysis to cartographic detail depicted on the pertinent NOAA nautical charts of the project site. The Remote Sensing Division (RSD) formulated the photographic mission instructions for this project following the guidelines of the project instructions sent to Tuck Engineering, Inc. (now Tuck Mapping Solutions, Inc.) March 11, 2002, from Captain John Bailey. The instructions discussed the projects purpose, geographic area of coverage, scope and priority; photographic and ground control requirements; flight line priority; tide and sun angle coordination; Global Positioning Systems (GPS) data collection procedures and guidelines for both kinematic and static surveys; data recording and handling instructions; and contact communication information.

Nautical charts provided by NOAA showed the limits of the Color, B&W IR and tide sensitive photography areas. Photo scales for the Color and B&W IR photography were determined to attain the required mapping accuracies. A wavier to utilize a 700nm filter during the acquisition of the B&W IR film was approved. NOAA approved a wavier for this filter on the camera without requiring a new camera calibration report by the USGS. Included in correspondence from Tuck Mapping Solutions, Inc. to NOAA on July 25, 2002, was a document titled Quality Control

Procedures for NOAA Coastal Mapping Projects. These procedures outline the requirements Tuck Mapping Solutions, Inc. followed during the project.

Field Operations

The photographic mission operation was conducted on December 2 and December 7, 2002 and October 16, 2003 with a Piper Navajo aircraft. Ten (10) strips of natural color and eighteen (18) strips of black and white infrared tide coordinated photography were acquired through the use of Wild RC-30 cameras, NOAA camera designation numbers 11 and 16. In the spring of 2003, the NOAA camera designation number 11 had a lens separation. The project was delayed until NOAA camera designation number 16 was tested and approved. At that time the weather in the Savannah area had entered the summer pattern. Photography for the project was completed on October 16, 2003 at a nominal scale of 1:24,000 and 1:18,000. Kinematic GPS data was acquired as an integral part of photographic mission operations in compliance with the project instructions.

Tuck Mapping Solutions, Inc. (formerly Tuck Engineering, Inc.) recovered NGS stations FAA SAV A (AA2780) and FORT PULASKI (CK 3760) to support the aerial mission. GPS data was submitted for OPUS Solutions to verify the stations. Static GPS methods were used to locate aerial control and check points. GPS data was post processed to provide final positions of the aerial control. See the Photographic Flight Reports and Ground Control Reports for additional information.

GPS Data Reduction

GPS data was collected and processed to provide precise positions of camera centers for application as photogrammetric control in the aerotriangulation phase of the project completion. Tuck Mapping Solutions, Inc. acquired static GPS datasets of NGS stations FAA SAV A (AA2780) and FORT PULASKI (CK3760) during photography missions on December 2 and 7, 2002 and October 16, 2003. After the flight missions on December 2 and 7, 2002, the data was downloaded and processed using Flykin Suite Version 5.22 software. After the flight mission on October 16, 2003, the data was downloaded and processed using Graf-Nav Version 6.0 software. Multiple trajectories were compared during the processing phase to ensure accuracy. Camera event file data was then applied to the final trajectory to obtain coordinates for the photo centers. A GPS Data Processing Report was written and is on file with other project data within the RSD Applications Branch (AB) Project Archive.

Aerotriangulation

Routine softcopy and analytical aerotriangulation methods were applied to establish the network of precise camera positions and other control for mapping, and to provide model parameters and orientation elements required for digital compilation. The Softcopy Aerotriangulation work was initiated by John F. Kenefick (JFK), Inc. personnel in March 2003 utilizing a digital photogrammetric workstation (DPW) which is a configuration of computer processor and monitor, ZI ImageStation Photogrammetry Manager (ISPM) software, stereographic viewing equipment and associated peripheral devices. The Analytical Aerotriangulation work was initiated by JFK, Inc.

personnel in March and December 2003 and consisted of conventional pugging of the diapositives and measuring on analytical stereoplotters.

Upon completion of the measurement process, the data was exported and processed in JFK, Inc's PC-RABATS/BRATS Aerotriangulation software. The December 2, 2002 B&W IR MLLW 1:18,000 and 1:24,000 were processed as individual blocks. The December 7, 2002 color photography was processed as one block. The October 16, 2003 B&W IR MHW 1:18,000 and 1:24,000 was processed as one block. Upon successful completion of the block adjustment, PC-RABATS/BRATS software provided the RMS of the standard deviations of the residuals for all aerotriangulated ground points, which were used to compute a predicted horizontal circular error of 1.6 feet for the color photographs, 1.9 feet for the 1:24000 B&W IR MLLW, 1.7 feet for the 1:18000 B&W IR MLLW and 1.9 feet for the 1:24000 and 1:18000 B&W IR MHW photographs. All accuracies were based on 95% confidence level. An Aerotriangulation Report is on file with other project data within the RSD AB Project Archive.

The project database consists of camera calibration data, interior orientation parameters for each frame, airborne GPS antenna position and offset data, adjusted exterior orientation parameters for each frame, and positional listing of all measured points, the control file and refined image coordinates as in the Project Database section of the Aerotriangulation Report. Positional data is based on the North American Datum of 1983 (NAD 83), and is referenced to the Georgia East State Plane Coordinate System.

Compilation

The data compilation phase of the project was accomplished by Tuck Mapping Solutions, Inc. from March 2003 thru March 2004. Digital mapping was performed using a DPW in conjunction with the Boeing-Autometric SoftPlotter 4.0 KDMS module and the utilization of a Leica BC3 and Kern DSR14 analytical stereoplotters in conjunction with KDMS NT 13.2. Feature identification and the assignment of cartographic codes were based on image analysis of 1:24,000 scale natural color photography, 1:18,000 and 1:24,000 scale black and white infrared photography and information extracted from appropriate NOAA Nautical Charts and US Coast Guard Light List. Cartographic feature attribution was assigned in compliance with the Coastal Cartographic Object Attribute Source Table (C-COAST) as required for clarity.

Most cartographic features were compiled from the natural color photography to meet a horizontal accuracy of 3.2 feet at the 95% confidence level for all but the MLLW and MHW line. Using B&W IR 1:24,000 imagery, the MLLW line and any cartographic features were compiled to meet a horizontal accuracy of 3.8 feet at the 95% confidence level. Using B&W IR 1:18,000 and 1:24,000 imagery, the MHW line and any cartographic features were compiled to meet a horizontal accuracy of 3.8 feet at the 95% confidence level. This predicted accuracy of compiled, well defined points is derived by doubling the circular error derived from aerotriangulation statistics.

The following provides information on aerial photographs used in the project completion process:

Date	Time (UTC)	Roll Number	Film Type	Photo Number	Scale (nominal)	Tidal Stage (Ft) (MLLW)
12-02-02	1716-1840	0211R01	IR	0000-0009	1:24,000	-0.93' to 0.60'
12-02-02	1903-1912	0211R01	IR	0100-0113	1:18,000	1.29' to 1.67'
12-07-02	1633-1821	0211CN01	NC	0001-0168	1:24,000	5.00' to 7.40'
10-16-03	1549-1559	0316R01	IR	0001-0014	1:18,000	6.24' to 6.48'
10-16-03	1607-1657	0316R01	IR	0015-0087	1:24,000	7.04' to 7.19'

The Tidal Stage for the natural color is based on observations recorded by the NOS gauge at Fort Pulaski (867-0870 CK0697), Savannah River, GA at the time of photography and interpolated for various exposures of B&W IR photography. During the time period of all the flights, the range of tides at Fort Pulaski was 8.4 feet.

Final Review

A Tuck Mapping Solutions, Inc. senior team member completed the final review in November 2004. The DCFF was evaluated for completeness and accuracy. Data review consisted of an on-line and off-line evaluation of digital compilation and hard copy products. The on-line review comprised of reviewing stereo models on a DPW for cartographic feature codes selection and positional accuracies of features. The cartographic feature attribution was judged to conform to C-COAST specification. The off-line evaluation compared hard copy plots of the project data with the largest scale nautical charts available. A copy of the NOAA nautical charts 11511 Ossabaw and St. Catherine's Sounds, 1:40,000, 16th edition, December 15, 2001; 11512 Savannah River and Wassaw Sound 1:40,000, 59th edition, January 01, 2003; 11516 Port Royal Sound and Inland Passages, 1:40,000, 30th edition, August 1, 2003; 11514 Savannah River - Savannah to Brier Creek, 1:20,000, 26th edition, July 1, 2002; 11509 Tybee Island to Doboy Sound, 1:80,000, 27th edition, January 12, 2002; and 11513 St. Helena Sound to Savannah River, 1:80,000, 23rd edition, December 23, 2000, were used for the chart comparison process.

Results of this off-line comparison combined with the on-line review may be examined by reviewing the Chart Maintenance Prints.

Project Final Data and Products

The following specifies the location and identification of the products generated during the completion of this project:

RSD Applications Branch Project Archive

- Hard copy of Airborne Positioning and Orientation Report
- Hard copy of Aerotriangulation Report
- Page size graphic plot of DCFF contents
- Hard copy of the Project Completion Report

RSD Electronic Data Library:

- Project Database
- DCFF: GC-10536
- Digital copy of DCFF in Shapefile format
- Digital Copy of Project Completion Report in Adobe PDF format

NOAA Shoreline Data Explorer

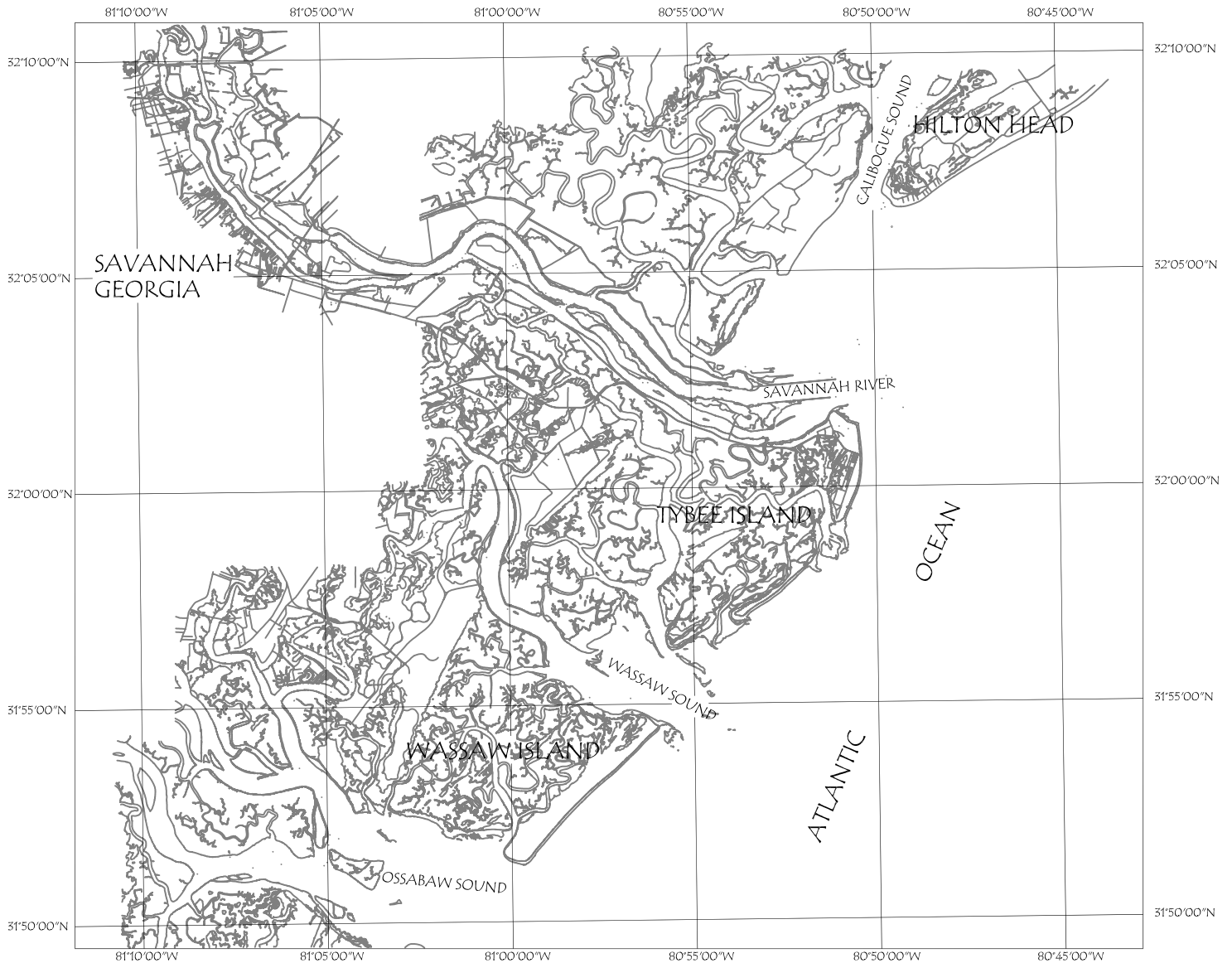
- DCFF: GC-10536
- Metadata file for GC-10536 (NOAA will prepare this file)
- Digital Copy of the Project Completion Report in Adobe PDF format

Please refer to the attached diagram for location of the project.

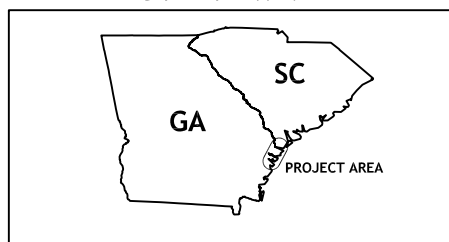
End of Report

HILTON HEAD ISLAND to WASSAW ISLAND

SAVANNAH RIVER and WASSAW SOUND



OVERVIEW MAP



GA0201

GC10536